(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 279 620 A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 88301258.5

(22) Date of filing: 16.02.88

(51) Int. Cl.[4]: B 64 D 11/00
B 64 C 1/12

(30) Priority: 18.02.87 US 15839

(43) Date of publication of application:
24.08.88 Bulletin 88/34

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(71) Applicant: ADVANCED TECHNOLOGY & RESEARCH INC.
14201 Myerlake Circle
Clearwater Florida 34620 (US)

(72) Inventor: Humphries, David R.
2073 Skimmer Court, No. 223
Clearwater Florida 33520 (US)

Fetterhoff, Donald C.
5055 - 29th Street South
St. Petersburg Florida 33712 (US)

Higgins, William R.
13979 Lakepoint Drive
Clearwater Florida 33520 (US)

(74) Representative: Jones, Alan John et al
CARPMAELS & RANSFORD 43 Bloomsbury Square
London, WC1A 2RA (GB)

(54) Aircraft shell module.

(57) Starboard (30) and port (32) arcuate panel sections having a dampening layer (80) between two honeycomb layers (82) form a cocoon or module (10) which is mounted in multiple elastomeric isolators (38, 42, 72, 78) located within channel members (40, 44, 74, 79). Starboard support bracket (46), attached to the interior of the aircraft skin (12) supports the channel (44) adjacent deck (14). Port support bracket (90) supports channel (79). The module (10) is thereby spaced apart from the aircraft frame (12). There is a resulting diminution of acoustic transmission from the aircraft frame (12) to its interior passenger area (18).

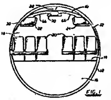

FIG. 1

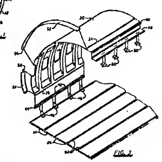

FIG. 2

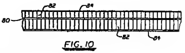

FIG. 10

EP 0 279 620 A2

Dascription

AIRCRAFT SHELL MODULE

Background of The Invention

1. Field of the Invention.

This Invention relates to aircraft interior modules. More particularly, it refers to an aircraft interior made of molded honeycomb panels with a layer of damping material bonded within the panels and the panel mounted so as to avold direct contact with the interior of the aircraft skin.

2. Description of the Prior Art.

Interior insulation systems for airplanes have been well known for a long period of time. Improvements on these systems such as shown in U.S. Patent 3,740,905 have not emphasized sound absorbing properties. However, sound absorption is becoming mora and more important because of advanced power systems for new aircraft.

The level of low frequency sound impinging on tha fuselage of future propfan powered airplanes is predicted to be higher than tha level of low frequency jat exhaust noisa that impinged on the aft fuselaga of turbojet powared 707 and DC8 airplanes. The level of structura borne noisa from propfan power propagating as vibration through tha structure of a fuselaga may wall excaad that axparianced on existing turbofan powered airplanas such as 727's and DC9's with aft mounted engines.

In 1986, passengers in newly delivered madium to long range transport airplanes (and the airlines that oparata those airplanas) wara accustomed to the laval of acoustical comfort typifiad by the noise levals in 737, 300 and MD 80 airplanas whare the levels of angine noisa and boundary layar noisa ware well below tha level of noise from advancad propfan propulsion systems.

A major task of the manufacturars is to find a means to introduce tha fuel efficiency of advanced propfan angines without dagrading the level of acoustical comfort provided for the passengars and crew by current technology transports.

Many business jet airplanes hava special requirements for low interior noise levels during cruise. The interiors of most business jet airplanes are not installed by the airplane manufacturer becausa of the great variety of custom designs which are offered for individual operators. Airplanes are delivered in a "graen" condition to "completion centers" for installation of the interior. To achieve the desired low interior noise levels, the installer of the interior utilizes special techniques and various combinations of damping material, vibration absorbers, vibration isolators, massive septa, and sound absorbing material.

A conventional approach to achieve low cabin noise levels has been to install fiberglass blankets between the fuselage frames for high frequency noise reduction. Noise reduction at low frequencies is provided by a massive septum made from a sheet of loaded vinyl (lead vinyl) outboard of the interior trim panal.

Double wall concepts hava been avaluated theoretically and experimentally for transport category airplanes and versions of the concept are incorporated in all passenger carrying aircraft. The skin of tha airplane forms one of the two walls; the interior sidewall trim panels and the ceiling panels form the other wall. A unifiad approach to a double wall has not been developed for transport category airplanes.

Summary of The Invention

We have invented a module for aircraft that is self supporting and can contain all necessary interior aircraft auxilliary equipment as well as acoustical panel components to substantially reduca engine noise to persons within the aircraft. Our module is capable of being built in a factory and then installad in sections within tha "grean" condition aircraft.

The module has two side panels which are each arcuate in shape and elongated dack panels. Each panel contains a layer of damping material betwean layars of a honaycomb material with a structural face forming the exterior of tha panel. The first or upper end of each module side panal is mounted in multiple alastomeric isolators locatad in an ovarhaad channel. The channel is hald in placa by an ovarhead mounting plate which in turn is held in placa by multiple support brackets attached to the ovarhaad of the fuselaga intarior.

The second or lower and of each module panel is mounted in multipla elastomeric isolators mountad in raspactive port or starboard channels. Thesa channals are attachad to multipla support brackets which are in turn attached to the raspective port or starboard side of a fuselage deck or floor beam. The fusalage deck is covarad with rectangular panals.

The antire modula is spacad apart from tha intarior fuselage of the aircraft. Consequently, tha panels are held rigidly but hava no diract contact with structural noise transmitting alemants of tha aircraft.

Brief Description of The Drawings

The present invention may be best understood by those of ordinary skill in the art by referenca to the following detailed description when considered in conjunction with the accompanying drawings in which:

Fig. 1 is a cross-saction view of an aircraft fusalaga in which the one aisle modula of this invention has been installed.

Fig. 2 is a cross-section view of an aircraft fuselage in which the two aisle module of this invention has been installed.

Fig. 3 is an exploded view of one section of the module.

Fig. 4 is a cross-section view of the acoustical sandwich in the aircraft deck.

Fig. 5 is a broken section view of a panel mounted in an isolator.

Fig. 6 is a front view of a first end of each

panel joined together and some suspended interior accessory equipment.

Fig. 7 is a front elevation view in section of the first end of each panel joined together.

Fig. 8 is a front elevation view in section of the second end of the starboard module panel mounted within the starboard isolators.

Fig. 9 is a front elevation view in section of the second end of the port module panel showing a through bolt mount.

Fig. 10 is a cross-section view of the panel layers.

Detailed Description of The Invention

Throughout the following detailed description similar reference numerals refer to similar elements in all figures of the drawings.

With reference to Figures 1 and 2, the module 10 is shown spaced apart from the aircraft skin 12. The aircraft has a deck panel 14 and under the deck panel is a storage area 16. The passenger space 18 contains seats 20, starboard luggage box 22 and port luggage box 24 and in Fig. 2, overhead luggage box 26. The module support beam 28 is located in the overhead area of the aircraft.

The module 10 is made up of a starboard panel 30 and a port panel 32. The starboard panel 30 has a first end 34 and a second end 36. See Fig. 3.

The first end 34 of starboard module panel 30 is mounted in multiple elastomeric starboard overhead isolators 38 which are frictionally inserted within channel 40. In like manner, the second end 36 of module panel 30 is mounted in starboard deck isolators 42 which are mounted in a starboard deck channel 44.

The overhead channel 40 is held in place by mounting bracket 50 and longitudinal close-out member 48. Bolt 49 and nut 51 hold the overhead assembly of 38, 40, 48, 50, 72 and 74 to support beam 28.

Channel 44 is held in place by starboard support brackets 46 mounted to the aircraft floorbeam 14. A trim panel 45 can be applied to the side of channel 44 facing the inside of the aircraft.

Each module panel is attached to its adjacent module panel by an overhead module joiner 52 and a starboard or port module joiner 54. An overlap clip 56 on the overhead joiner 52 and overlap clip 58 on the starboard joiner 54 are hooked to the window openings in the module. Overhead joiner 52 and joiner 54 retain foam seal 60 in place.

Seat track 86 supports structural deck panels 14. Acoustical deck panels 88 cover the deck panels 14. Groove 92 in the seat track 86 receives the seat 20 vertical support member 94. See Figs. 1 and 4.

Accessory equipment such as overhead bin 22 is attached to a support fitting 62 which is fastened to honeycomb panel 30. Overhead bins such as 26 are supported by struts 64 attached to mounting bracket 50. A frameliner 66 encloses the overhead space 68 of the module. This overhead space 68 contains the additional auxiliary equipment such as air vents 70.

In like manner, the first end 76 of port module panel 32 is mounted in the overhead area of the aircraft in elastomeric isolators 72 contained within channel 74. The second end 77 is mounted in isolators 78 contained within channel 79. A through bolt 96 prevents forward movement of channel 44 or 79.

Each panel 30 or 32 contains a damping sheet of vinyl 80 separating honeycomb cores 82 on each side. Exterior to each honeycomb core 82 is a structural face 84. The panel is lightweight and suppresses transmission of sound while still maintaining structural integrity.

Each isolator consists of a cartilage of vibration absorbing material which is usually an elastomer but can be substituted with other resilient vibration absorbing materials. Each isolator is frictionally attached to the interior of a channel. Each support bracket 46 or 90 ie provided with means 91, 93 to adjust their position. The number of support brackets 46 or 90 is optional and is determined entirely by the structural requirements of the aircraft. The configuration described rigidly supports the panels within the aircraft and is spaced apart from the fuselage skin so that a cocoon structure is created which can support all interior acceseory equipment such as bins 22, 24 and 26 without sacrificing any acoustical dampening effect. The arcuate structure of the panels add additional support for these accessory items.

Minor modifications and equivalent elements can be substituted in the acoustical module without departing from the invention as described herein.

Claims

1. A cocoon structure (10) for acoustical protection of passengers within the interior of an aircraft fuselage (12) containing a fuselage deck (14) characterized by:

(a) a multiplicity of panels (30, 32) held together in abutting end to end relationship by one or more joiner arches (52, 54);

(b) each panel having a port (32) and starboard (30) component with each component having first (34, 76) and second (36, 77) ends inserted into multiple isolators (38, 42, 72, 78);

(c) each isolator (38, 42, 77, 78) engaged within a channel member (40, 44, 76, 79) attached to a mounting element (46, 50, 90) structurally affixed to an interior fuselage surface of the aircraft; and

(d) one or more acoustical panels (88) covering the fuselage deck (14), the cocoon structure thereby being spaced apart from the fuselage of the aircraft.

2. A cocoon structure according to Claim 1 characterized by isolators (38, 42, 72, 78) containing an elastomerio cartilage of vibration absorbing material.

3. A cocoon structure according to Claim 1 or Claim 2 characterized by each port (32) and starboard (30) panel containing a central damping layer (80) between layers (82) of honeycomb

material and outer layers of a structurally supportive material (84).

4. A cocoon structure according to Claim 1 for the interior of an aircraft fuselage containing a fuselage deck (14), characterized by:

(a) contiguous pairs of arcuate port (32) and starboard (30) panels having a first (34, 76) and second end (36, 77);

(b) the first (34, 36) end of each panel mounted in multiple isolators (38, 72) located within separate overhead support channels (40, 74);

(c) multiple support brackets (46, 90) attached to a starboard and port side of the fuselage deck;

(d) an adjustable port support channel (79) attached to the support bracket (90) on the port side of the fuselage deck;

(e) an adjustable starboard support channel (44) attached to the support bracket (46) on the starboard side of the fuselage deck;

(f) multiple isolators (42, 78) mounted in the starboard and port channels for receiving and holding the second end (36, 77) of each arcuate panel; and

(g) the overhead support channels (40, 74) supported by an assembly attached to an overhead portion (28) of the fuselage (12), the arcuate panels (30, 32) thereby being spaced apart from the fuselage (12) of the aircraft.

5. A cocoon structure according to Claim 4 characterized by the isolators (38, 42, 72, 78) having an elastomeric cartilage of vibration absorbing material.

6. A cocoon structure according to Claim 4 or Claim 5 characterized by the fuselage deck (14) being covered by multiple panels (88) of a honeycomb material (82).

7. A cocoon structure according to Claim 4, 5, or 6 characterized by the panels (30, 32) containing a layer of damping material (80) between layers of honeycomb material (82).

8. A method of mounting an aircraft interior module (10) within an aircraft fuselaage (12) containing a fuselage deck (14) characterized by:

(a) mounting support beams (28) from an overhead interior surface of the fuselage (12);

(b) attaching a mounting plate containing a port (74) and starboard (40) overhead channel member to the support beams (28) by multiple overhead brackets (50);

(c) attaching a port (79) and starboard (44) deck channel member to a multiplicity of port (90) and starboard (46) mounting brackets respectively affixed to the fuselage deck (14);

(d) mounting multiple isolator members (38, 42, 72, 78) in each channel member;

(e) mounting a first end (34) of an arcuate starboard acoustical panel (30) in the isolators (38) in the starboard overhead channel member (40) and a second end (36) in the isolators (42) in the starboard deck channel member (44);

(f) mounting a first end (76) of an arcuate port acoustical panel (32) in the isolators (72) in the port overhead channel member (74) and a second end (77) in the isolators (78) in the port deck channel member (79);

(g) mounting flat deck acoustical panels (88) over the fuselage deck (14) to form a module spaced apart from the aircraft fuselage (12).

9. The method according to Claim 8 characterized by joining adjacent panels (30, 32) together side to side by one or more joiner members (52, 54) to form a module (10) within substantially the entire interior space of the aircraft fuselaga (12).

10. The method according to Claim 8 or Claim 9 characterized by mounting panels (30, 32) containing a central damping layer (80) between layers of honeycomb material (82) and outer layers of a structural supportive material (84).

0279620

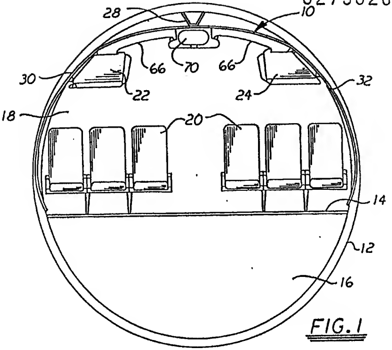

FIG. 1

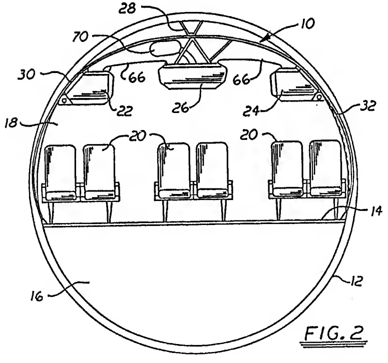

FIG. 2

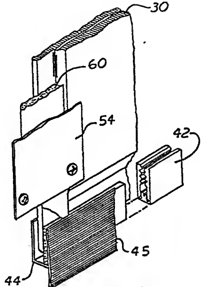

FIG. 5

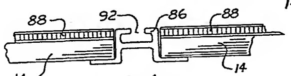

FIG. 4

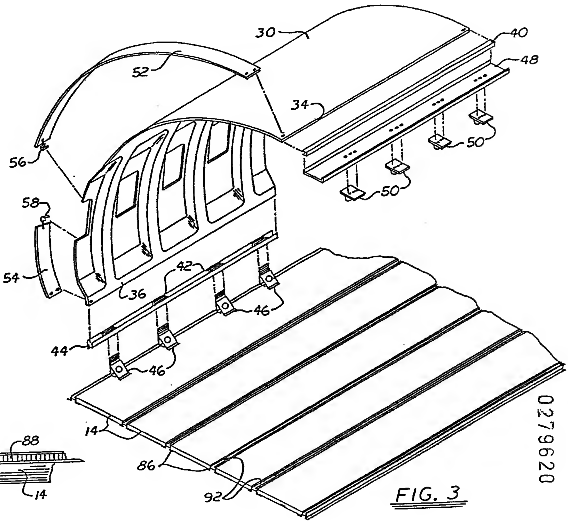

FIG. 3

0279620

0279620

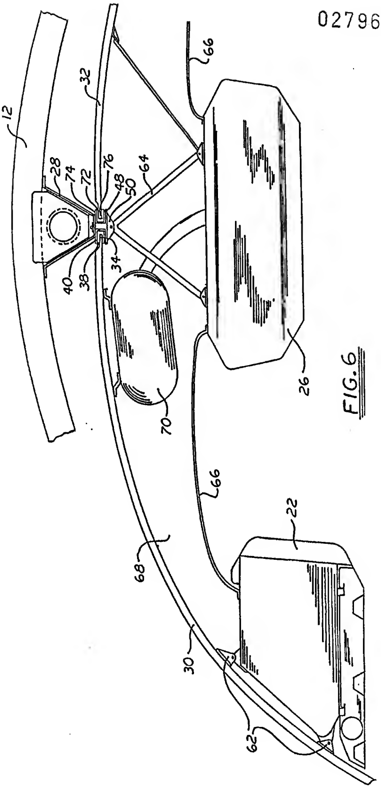

FIG.6

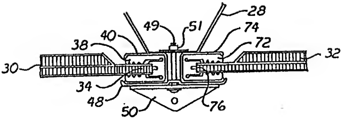

FIG. 7

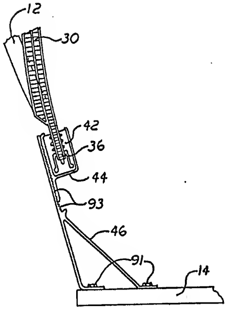

FIG. 8

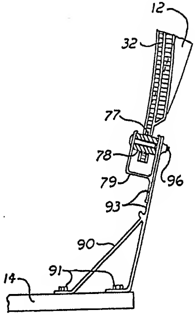

FIG. 9

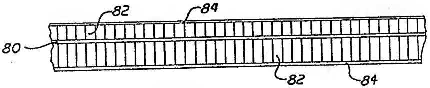

FIG. 10